

MISSISSIPPI SPR-1(41), PART II

GENERAL COMMENTS ON RESEARCH WORK PROGRAM
FOR FISCAL YEAR 2003

The expected SPR research work program allocation for FY 2003 totals \$1,632,728 and includes a National Cooperative Highway Research Program (NCHRP) contribution of \$359,200 for FY 2003, a TRB Correlation Service contribution of \$86,740 and pooled-fund studies totaling \$430,000 as detailed in the program tabulation and narrative included in this document. The NCHRP funding is 5.5% of the total SPR allocation (Parts I and II). This work program tabulation also includes renewal statements for all on-going line items. The renewal statements for state studies contain financial information including total study budget, total expenditures to date, and cost estimates for fiscal year 2003. Also included in the renewal statements for state studies are narrative descriptions of study objectives, accomplishments of the past year, and work planned for fiscal year 2003. Beginning and completion dates are shown for each state study. Line items other than state studies have narrative descriptions of scope, objectives and anticipated activities along with a cost estimate. These tabulations and renewal statements constitute the FY 2003 research work program.

The pooled fund studies, TRB Correlation Service and NCHRP are funded with 100% SPR Part II funds (no state match). The thirty-seven line items in the tabulation mentioned above includes only those items for which there is a state match in the funding.

State study numbers in this work program are the same as those currently being used, and they will remain the same in all correspondence. Study proposals for future submissions will be numbered sequentially.

The SPR allocation for FY 2002 was \$1,843,969. To be on the conservative side, an allocation in the same amount as FY 2001 is being used for FY 2003. This would amount to \$1,632,728 and the state match would be \$281,960.

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM 1

Research Administration

This line item covers those direct costs chargeable for administration which, due to their nature, are difficult to apportion to the separate studies. Chargeable categories include preparation of contracts and proposals, collection of background information on individual studies, acquisition of basic reference materials and bibliographies, determining the qualifications of institutions and other groups for performing studies, providing for report review, and miscellaneous implementation of research products not specially accounted for elsewhere. Routine surveillance and support of contracted research studies, where not provided for elsewhere, are also included in this item. Overhead items such as housekeeping, accounting, and office rental will be included in these charges.

Cost Estimate for FY 2003

Salaries (Regular Employees)	\$171,632
Employee Benefits	\$48,368
Materials, Supplies, and Services	15,000
Travel and Sustenance	<u>10,000</u>
Total	\$245,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM 2

Long-Term Pavement Performance

This line item is for support of the Long-Term Pavement Performance (LTPP) program begun under the Strategic Highway Research Program (SHRP) and now a part of the Federal Highway Administration (FHWA). Activities covered include site nomination, site verification, historic data searches, support for material sampling and field-testing, construction supervision, and technology transfer activities associated with LTPP and SHRP product implementation.

Activities conducted in FY 2002 included:

- marking and signing of LTPP sites
- support for field data collection

Activities planned for FY 2003 include:

- maintaining signage for existing LTPP sites
- support for all LTPP activities

Cost Estimate for FY 2003

Salaries (Regular Employees)	\$3,000
Employee Benefit	840
Materials, Supplies, and Services	760
Travel and Sustenance	<u>400</u>
Total	\$5,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM 3

Implementation of Research Projects

This line item funds Research Division activities relating to implementation of research studies.

Implementation Activities consist of field and office activities that apply research results to the solution of operational problems in the transportation area. Examples of these activities are:

1. Applying new products and/or procedures in the field to specific field problems.
2. Short-term field and/or office technical support in trouble-shooting and design.
3. Assistance in development of specifications and tests to implement new products or procedures.
4. Identifying areas in which research is required.
5. Initial preparation costs associated with proposed research.

Research information for implementation may originate from MDOT's Research Program (in-house and Contract), including both completed and ongoing studies; from other state transportation agencies' experiences and research; from national and international sources, from the FHWA; and from major research sources such as NCHRP, Corps of Engineers, etc.

Cost Estimate for FY 2003

Salaries (Regular Employees)	\$142,000
Employee Benefits	39,760
Materials, Supplies, and Services	8,240
Travel and Sustenance	<u>10,000</u>
Total	\$200,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM 4

Technology Transfer

This activity funds Research Division activities relating to the distribution of information about transportation technologies to any of MDOT Research Division's transportation customers. These are not new activities but have been on going for many years. This line item is included to facilitate better documentation of technology transfer activities.

There are many similarities between items falling under the categories ***Technology Transfer*** and ***Implementation*** of this work program. For the purposes of this work program, a distinction will be made that ***Implementation*** will be concerned with actively putting research results into practice while ***Technology Transfer*** will refer to efforts to disseminate information. One noteworthy example of work in this area is technology exchange relating to implementing of Superpave. Other examples of technology transfer are:

- making presentations of research results to various groups such as universities and technical societies
- participation in seminars and training courses
- distribution of research results
- inputting research and research-in-progress results into the Transportation Research Information Service (TRIS)

The SPR WORK PROGRAM-PART I, Technology Transfer, provides direct support to the Center for Technology Transfer (T²) at Jackson State University, and those activities and funds are not included in the above line item, Technology Transfer.

Cost Estimate for FY 2003

Salaries (Regular Employees)	\$24,000
Employee Benefits	6,720
Materials, Supplies, and Services	1,280
Travel and Sustenance	<u>8,000</u>
Total	\$40,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM 5

Pavement Management

This item covers the activities of the Research Division relating to the development, implementation, and operation of the Department's Pavement Management System.

Activities include awareness of national pavement management state-of-the-art and practice, administration of field data collection and statewide database development, administration of pavement condition survey contracts, quality assurance for condition surveys, in-house software development, administration of contract software development, planning and conducting in-house training, administration of contract pavement management research, and implementation of pavement management research.

Cost Estimate for FY 2003

Salaries (Regular Employees)	\$142,000
Employee Benefits	39,760
Materials, Supplies, and Services	8,240
Travel and Subsistence	<u>10,000</u>
Total	\$200,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 6	STATE STUDY NO. 132
TOTAL STUDY BUDGET: \$40,000	TOTAL STUDY COST TO DATE: \$4,909
DATE STARTED: 01/01/99	COMPLETION DATE: 09/30/03
STUDY TITLE:	Performance and Evaluation of Median Barrier Curbs and Traffic History Devices at Highway Railroad Grade Crossings in Mississippi
RESEARCH AGENCY:	Mississippi Department of Transportation
PRINCIPAL INVESTIGATORS:	John W. Avent

Objective:

The objective of this study is to determine if median barrier curbs with delineator panels will reduce the risk of collisions at highway-rail grade crossing both in urban and rural areas, and if so, to determine the optimal length of an effective installation. A second objective is to determine if the installation of video cameras along with signs so stating that these devices are monitoring the grade crossings will also reduce the drive-arounds.

Five different tasks will be undertaken to satisfy the objectives:

- Selection of Highway-Rail Crossings.
- Procurement of Equipment.
- Installation of Equipment.
- Data Collection.
- Reporting and Implementation Plan.

This study is being conducted jointly by the Research Division, Rails Division, and Traffic Engineering Division.

Progress:

The department received a finalized agreement with the Illinois Central Railroad, which was one of the five original participating railroads. The other four railroads have not made such an agreement to date; therefore, no further effort will be made with them to obtain this agreement. Two highway-rail crossing locations have been selected in Jackson, Mississippi. One location is at Northside Drive and the other one is at McDowell Road.

Plans for FY 2003:

Install the cameras and curbs at both sites. This study will monitor the traffic for a period that is long enough to determine that the devices are working and to what amount.

Cost Estimate for FY 2003: \$35,091

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 7	STATE STUDY NO. 133
TOTAL STUDY BUDGET: \$97,276	TOTAL STUDY COST TO DATE: \$46,856
DATE STARTED: 10/01/99	COMPLETION DATE: 09/30/05
STUDY TITLE:	Soil Stabilization Field Trial
RESEARCH AGENCY:	University of Mississippi (This study will be conducted jointly with the Portland Cement Association sharing costs)
PRINCIPAL INVESTIGATOR:	K.P. George

Objective:

A field trial is proposed to investigate the effectiveness of fly ash or other methods such as pre-cutting the base at regular intervals or pre-cracking in mitigating the shrinkage-cracking problem in soil-cement. The Department has been using lime-fly ash (LFA) for stabilization of bases, and this field study will compare the performance of cement sections with LFA included in the program.

The research study is proposed to have a field trial incorporating one section of cement, another of reduced cement and fly-ash, a third section with pre-cut cement layer, a fourth section with induced pre-cracking, a fifth section incorporating lime and fly-ash, and the last section with ground granulated blast furnace slag as an additive.

Progress:

A literature review has been performed to review any previous research that would relate to the study. A project was identified for the test sections on MS 302 in Marshall County. Samples of the select material from this project location obtained and laboratory tests performed. Mix designs for each test section were composed based on these laboratory test results.

Six test sections were constructed and samples molded from the field-mixed material for strength testing at 7, 14, 28 and 90 days. Moisture/density testing of the in-place material was performed at the time of construction. Geogauge, FWD (performed by MDOT) and Clegg hammer testing was performed, and crack surveys obtained, over a 28-day monitoring period prior to placement of the asphalt base course. Twenty eight-day field cores were also collected and tested for unconfined compressive strength. Backcalculations of pavement layer moduli from FWD deflection basins were performed and these results compared to Geogauge results. An interim report was published by the principal investigator.

First-year field monitoring, including deflection tests employing FWD, retrieving 4-inch diameter cores and a detailed crack survey was conducted. The MODULUS 5.1 computer program was used to analyze the FWD deflection data. Core samples were tested for UCS.

Progress Continued:

Interim Report II was submitted to MDOT. This report indicated that all of the stabilized materials gained strength during the 440-day period from time of construction to the time of first-year monitoring, with the LFA stabilized material achieving only marginal strength gain. The modulus of each material increased during this time period. No reflection cracks were observed in the crack survey.

Plans for FY 2003:

A laboratory study will be conducted in order to reaffirm the strength gain of precracked cement-treated soil. 2" x 3" x 11" beams will be cast. Some of these beams will be precracked within 24 to 48 hours. The material stiffness of both the cracked and the uncracked beams will be determined by employing modal analysis. Temporal variation of modulus of uncracked beams will be compared with that of the cracked beams.

The third-year investigation of test sections will be performed in July of 2003. FWD testing will be conducted and a crack survey will be performed in each of these test sections.

Cost Estimate for FY 2003 \$8,000

The PCA and the University of Mississippi are providing funds to supplement this effort.

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 8	STATE STUDY NO: 138
TOTAL STUDY BUDGET: \$75,000	TOTAL STUDY COST TO DATE: \$9,035
DATE STARTED: 10/01/99	COMPLETION DATE: 03/31/06
STUDY TITLE:	In-House Support to State Study No. 133
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

Objective:

This study will be conducted to support State Study No. 133 "Soil Stabilization Field Trial" which is a proposed contract with the Department of Civil Engineering at the University of Mississippi. The field site location, layout, and sampling to support the contract study will be conducted by this in-house study.

Progress:

Federal Aid Project No. NH-0021-01(104)PH2 was selected as the project for the current study test sections. The project site is located on MS 302 between the Desoto/Marshall County line and US 72 in Marshall County. Meetings were conducted with the principal investigator of State Study No. 133, the Contractor/Subcontractors and MDOT personnel to ensure that the objectives of State Study No. 133 and the field methodologies utilized to meet these objectives were understood by all parties involved in the study. Samples of the select material from the project were obtained and submitted to the University of Mississippi for the required laboratory testing.

The construction of the various test sections was coordinated by MDOT and included a cement treated control section, cement treated with application of a vibratory roller, cement and fly-ash, lime-fly ash, ground granulated blast furnace slag, and a cement treated section precut at 10-ft. intervals. The Department's falling weight deflectometer (FWD) was utilized for testing of the subbase prior to placement of the first lift of asphalt. The final draft of the interim report, which included the construction of these test sections and testing performed in conjunction with this construction, was reviewed.

As part of the first-year field monitoring of the test sections, FWD testing was conducted in, and field cores obtained from, these sections. Interim Report II includes this phase of field monitoring and was reviewed.

Plans for FY 2003:

Provide support as required by the principal investigator for long term monitoring of the test sections. For this fiscal year, this includes MDOT testing these sections with the falling weight deflectometer (FWD). Review technical memorandum.

Cost Estimate for FY 2003 \$3,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 9	STATE STUDY NO: 140
TOTAL STUDY BUDGET: \$24,500	TOTAL STUDY COST TO DATE: \$15,311
DATE STARTED: 10/01/99	COMPLETION DATE: 12/31/02
STUDY TITLE:	Evaluation of E-Krete for Rut Filling
RESEARCH AGENCY:	Polycon, Inc. and Research Division, Mississippi Department of Transportation
PRINCIPAL INVESTIGATOR:	Randy L. Battey

Objective:

Rutting of asphalt pavements presents a serious problem for highway agencies worldwide. There are several ways to rehabilitate rutted asphalt pavement, including milling by itself, milling and overlay, overlay without milling, and rut filling. Rut filling with various materials, primarily asphalt based, has been done for several years.

A new material E-Krete, manufactured by a Mississippi Corporation, Polycon, Inc., is under evaluation as bridge deck surface treatment and for spall repair on concrete pavement and structures. E-Krete is a Portland cement based material that has excellent adhesion properties. A 375-foot test section of E-Krete was installed, at Polycon's expense, in a severely rutted section of the outside lane of the northbound lanes of I-55 in August 1999. This problem statement is for a more carefully engineered evaluation of E-Krete for rut filling.

Progress:

A rutted 1500-foot length of U.S. Highway 49 Southbound in Madison County between the two southern-most relief bridges of the Big Black River was selected for this study. Various application techniques were experimented with and documented with the goal of determining the method that would provide the highest level of performance. Initial distress surveys and friction testing have been performed and documented for inclusion in the final report upon completion of the study.

Two detailed distress surveys were performed on the test section, including rut measurements, crack mapping and friction testing, during FY 2002. A product evaluation force visited the section during the 3rd quarter.

Plans for FY 2003:

Continued monitoring and documentation of the test sections will be performed. A report will be generated and distributed to various interested agencies.

Cost Estimate for FY 2003 \$3,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 10	STATE STUDY NO. 141
TOTAL STUDY BUDGET: \$44,000	TOTAL STUDY COST TO DATE: \$13,738
DATE STARTED: 05/01/00	COMPLETION DATE: 12/31/02
STUDY TITLE:	Performance of Polymer Modified Hot Mix Asphalt Pavements – An Extended Evaluation
RESEARCH AGENCY:	Ergon Technical Development and Mississippi Department of Transportation
PRINCIPAL INVESTIGATOR:	Mike Hemsley and Randy L. Battey

Objective:

The objective of this research project is to continue observation and evaluation of the Polymer Modified Pavement Field Trial sections, located on I-55 northbound near Grenada, MS, for an additional 3 years in order to study any additional or new pavement distresses. This study will evaluate the modifiers in each of the sections, which include five different polymer sections, two crumb rubber sections, a gelled asphalt section and a section with no modifier to serve as the control section. Information gained from this research in using polymers and modifiers to overcome premature rutting and other distresses will continue to set Mississippi as one of the leaders in this field of study. It should be noted that Ergon Technical Development will provide all laboratory testing at no cost to the Mississippi Department of Transportation.

Progress:

Field operations began in May 2000 and comprised of cutting 152 – 6” cores, performing 90 sand patch tests, gathering rut data, performing friction testing and mapping the distresses in the test sections. All 152 cores were delivered to Ergon Technical Development for testing. Ergon reported all results from round one testing to the MDOT.

A second round of field operations was performed in June 2001 and comprised of cutting 46 – 6” cores, performing 90 sand patch tests, gathering rut data, performing friction testing and mapping the distresses in the test section. All 46 cores obtained during the second round of field operations were delivered to Ergon Technical Development for testing.

Rut data and surface friction data were collected on the sections in November 2001.

The third and final round of field operations was performed in August 2002 and was comprised of cutting 36 – 6” cores, performing 30 sand patch tests, gathering rut data, performing friction testing and mapping the distresses in the test sections. Preliminary work on the final report has begun.

Plans for FY 2003:

The final report will be completed and distributed to interested agencies.

Cost Estimate for FY 2003 \$7,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 11	STATE STUDY NO. 144
TOTAL STUDY BUDGET: \$70,000	TOTAL STUDY COST TO DATE: \$30,581
DATE STARTED: 10/01/00	COMPLETION DATE: 09/30/03
STUDY TITLE:	Profilograph Specification Study
RESEARCH AGENCY:	Mississippi Department of Transportation
PRINCIPAL INVESTIGATOR:	Randy L. Battey

Objective:

The current roughness specification utilized by the MDOT was developed over 10 years ago and there have been no significant changes since. The specification was developed based on the manual profilograph, which has since been replaced by the automatic unit. Also, unlike 10 years ago, industry is now utilizing high frequency rollers to compact their hot mix asphalt pavements. These rollers have a propensity for creating small scallops in the pavement surface, which due to the blanking band requirement in the current roughness specification are not taken into account when computing a profile index. However, these scallops are certainly felt by the traveling public and create a rougher ride quality. Based on the current specification, industry is not being penalized for a rough ride quality and in some instances contractors are being rewarded with incentive pays for a rough final ride surface. Most states have removed the blanking band from their roughness specification for this very reason. Many of the states have gone to the light weight profiler for their QC/QA of ride quality. The MDOT intends on utilizing the light weight profiler, which instead of producing a profile index value measures the International Roughness Index (IRI). This transition will take some time with undoubtedly a period of time where a dual specification (light weight profiler and profilograph) is in place. If the MDOT is to ever successfully make this transition, the current profilograph specification must be "tightened up" and data must be gathered comparing profile index values to IRI for Mississippi pavements.

Progress:

Roughness data has been gathered from approximately twenty (20) projects utilizing the "California type" profilograph, South Dakota type road profiler and the AARB walking profiler. Using this information the department has tentatively revised the current 907-403-12 and the 907-401-22 specifications with regards to surface smoothness. The major change involved in this proposed update is the removal of the .2" blanking band for Profile Index computation. The bump requirement has also been changed from .4" per 25' to .3" per 25' for all pavements.

The department has purchased a lightweight profiler capable of collecting both PI and IRI. Project funds were not utilized to purchase this equipment. Proof testing of the newly acquired lightweight profiler has begun.

Plans for FY 2003:

Continued proof testing of the lightweight profiler will be performed to enable the department to approve the collection of PI data utilizing the “inertial type” profiles for smoothness acceptance of MDOT projects. Additional data will be collected to assist the department with its future transition from Profile Index to International Roughness Index for construction acceptance.

Cost Estimate for FY 2003 \$39,419

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 12	STATE STUDY NO. 145
TOTAL STUDY BUDGET: \$86,000	TOTAL STUDY COST TO DATE: \$70,688
DATE STARTED: 10/01/00	COMPLETION DATE: 12/31/02
STUDY TITLE:	The Effect of End-Point Compaction on Superpave Mix Designs
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Tom White

Objective:

With fixed contact pressure and gyration angle, Superpave compaction effort is controlled by number of gyrations. Traffic level determines the desired initial (N_{ini}), design (N_{des}) and maximum (N_{max}) number of gyrations. Design asphalt content is selected at N_{des} . The initial Superpave protocol specified that specimens are compacted to N_{max} and the bulk density at N_{des} is interpolated based on specimen change in height. This approach is reasonable for some mixtures, however the change in height may not be linear for other mixtures, which could lead to an error in volumetric determinations. There is thought of changing the protocol to call for specimens to be compacted to N_{des} for selecting design asphalt content. After the design asphalt content is selected then the mixtures are compacted to N_{max} , to confirm air voids will be adequate through the mixture service life. There is industry concern about the effect of this change on design asphalt contents.

Progress:

Contact has been made with aggregate suppliers. Typical gradations and aggregate data have been obtained. Some of the information is being verified and information on typical mix designs has been received. Our library of standard test methods is being completed. Through discussion with the MDOT Materials Division a decision has been made to include five to ten percent RAP in each mix design. Ergon Refining has supplied asphalt for the project. Two asphalts are being utilized; PG 67-22 and polymer modified PG 76-22.

A test matrix has been developed to incorporate factors identified in the research proposal. The matrix also addresses comments from discussions with MDOT Research and Materials Divisions. The matrix is shown on the following page.

			<i>Gradations (Referenced to Restricted Zone)</i>											
			19 mm						12.5 mm					
			Above/Through			Below			Above/Through			Below		
			SS	LS	GR	SS	LS	GR	SS	LS	GR	SS	LS	GR
<i>Asphalt Binders</i>	PG 76-22	N _{des} 2												
		N _{des} 1												
	PG 67-22	N _{des} 2												
		N _{des} 1												

SS: Sandstone

LS: Limestone

GR: Chert Gravel

PG 67-22: Neat Asphalt

PG 76-22: Polymer Modified Asphalt

N_{des}: Number of revolutions for design characteristics

Aggregate testing including stockpile gradation, specific gravity, absorption, uncompacted void content, flat and elongated particle percentages and sand equivalences were performed on chert gravel, sand, and limestone aggregates. Aggregate blends were proposed for chert gravel 12.5 and 19 mm maximum size mixture gradations. APAC's Columbus laboratory conducted binder extraction of the RAP. Mixtures have been designed using aggregate types used in Mississippi.

A CoreLok device has been obtained and has been incorporated in evaluations of compacted specimens. This device was included to obtain additional information on which to evaluate results of compaction. It also helped to answer questions concerning bulk specific gravity determinations.

The draft final report has been started.

Plans for FY 2003:

Laboratory testing and analysis of the data will be completed thus enabling the report to be submitted early in the FY.

Cost Estimate for FY 2003 \$15,312

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 13	STATE STUDY NO. 146
TOTAL STUDY BUDGET: \$80,000	TOTAL STUDY COST TO DATE: \$50,000
DATE STARTED: 10/01/00	COMPLETION DATE: 09/30/03
STUDY TITLE:	Updating Mississippi Flood Frequency Reports
RESEARCH AGENCY:	United States Geological Survey
PRINCIPAL INVESTIGATOR:	K. Van Wilson

Objective:

Knowledge of magnitude and frequency of floods is essential to the design of bridges, highway embankments, culverts, levees, dams, and other structures near streams. Effective flood-plain management and determination of flood insurance rates require accurate information on magnitude and frequency of floods.

The statewide flood-frequency reports by Landers and Wilson (1991) and Wilson and Landers (1991) provided estimates of magnitude and frequency of floods at gaging stations and provided techniques for estimating magnitudes and frequency of floods at ungaged sites in Mississippi. Observed annual peak-flow data collected through 1988 at 358 gaging stations were used in the analyses. Since the 1991 statewide flood-frequency reports, an additional 11 years of observed annual peak-flow data has become available and data have been collected on several large floods. Also, the 1991 regional flood-frequency equations were developed using generalized least-squares (GLS) regression (Stedinger and Tasker, 1985; and Tasker and Stedinger, 1989). GLS regression had and still has advantages over the ordinary least-squares and weighted least-squares regression, but since the 1991 reports, Tasker and Slade (1994) demonstrated that GLS regression coupled with a site-specific approach [referred to as “interactive” by Tasker and Slade (1994) and as “region-of-influence” by Hodge and Tasker (1995)] had smaller root-mean-square errors than the traditional geographic regional approach. Analyses of flood frequency using these additional data with a site-specific approach may substantially change and improve the accuracy of techniques for estimating magnitudes and frequencies of floods in Mississippi.

Progress:

Research of flood-frequency techniques and compilations of flood data, including maximum known flood data, were continued. Multiple reports that describe the extreme flood events during the 20th century were scanned into highly compressed image file format. A preliminary summary of the significant flooding that occurred in Mississippi for 1994-98 was completed and submitted to the MDOT for review.

Additional flood and flood-frequency reports for the State by the U.S. Geological Survey and the U.S. Army Corps of Engineers were scanned into highly compressed image file

format. The scanned published reports containing drainage areas were edited and compiled into a spreadsheet format. A web page has been created that describes the project and provides selected historical floor and flood-frequency-technique reports.

GIS basin characteristic tools have begun to be tested.

Plans for FY 2003:

The objectives of this project are to prepare an updated version of the flood-frequency reports that would:

- Document the maximum known flood at gaged sites in Mississippi and compare with a previously published envelope curve;
- Document flood data and flood-frequency estimates at gaging stations in Mississippi; and
- Present methods for estimating the magnitude and frequency of floods in Mississippi having recurrence intervals ranging from 2 to 500 years.

Tidal record data along the Mississippi Gulf Coast will also be included. See the following web address for examples of data: <http://wtsodin.er.usgs.gov/camille/>

Estimated Costs:

The project will be done in cooperation with the MDOT, Research Division. The 3-year project will begin October 1, 2000, and will end September 30, 2003. It is anticipated that the results of this project will be reviewed and discussions toward renewal after 2003 will be made to include additional GIS work on automated basin delineation, which is currently in the development stages. The total estimated cost of the project is \$160,000 distributed over three Federal Fiscal years (October 1 to September 30) as follows:

	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>Total</u>
MDOT	\$ 20,000	\$ 30,000	\$ 30,000	\$ 80,000
USGS	\$ <u>20,000</u>	\$ <u>30,000</u>	\$ <u>30,000</u>	\$ <u>80,000</u>
Total	\$ 40,000	\$ 60,000	\$ 60,000	\$ 160,000

The availability of Federal matching funds is difficult to predict, but we will make every effort to secure funds to match all or part of the State funds. If Federal matching funds vary from those shown for each year, then the MDOT and USGS can discuss alternatives, such as, reducing scope or extending the time of the project.

Products:

Reports will be published that contain maximum known flood data, annual peak-flow data, flood-frequency estimated at gaging stations, and equations and (or) computer programs for estimating the magnitude and frequency of annual floods in Mississippi.

The reports will be provided in paper form (with a diskette or CD) and will also be made available in digital form on the Internet.

Cost Estimate for FY 2003 \$30,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 14	STATE STUDY NO: 147
TOTAL STUDY BUDGET: \$115,000	TOTAL STUDY COST TO DATE: \$94,623
DATE STARTED: 10/01/00	COMPLETION DATE: 03/31/03
STUDY TITLE:	Long Term Effect of Lime Fly Ash Treated Soils
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

Objective:

For approximately 20 years, the Mississippi Department of Transportation has been utilizing lime fly ash in base course construction. Recently questions as to the long-term effect lime fly ash has on soil strength and stability have been raised. This study intends on answering those questions by performing the following two tasks:

- A thorough literature search will be performed to determine what other agencies have discovered based on their experiences with lime fly ash treated bases that are over 10 years in age.
- Mississippi constructed several of their early lime fly ash treated bases as part of "Demonstration" or Research projects. These projects were well documented and the strength of the bases at the time of construction is known. As part of this project these early sites will be revisited and core samples will be taken. A comparison of the present day core properties will be made to the earlier data.

Upon completion of these two tasks, a comprehensive report will be generated detailing the findings of the study. It is estimated that it will take approximately one year to complete this research.

Progress:

This study was substantially expanded in scope subsequent to its initiation due to information obtained during the literature search. This information identified issues relevant to the performance of lime-fly ash (LFA) stabilized soil base and subbase course construction. These issues include: The determination of in-situ structural layer coefficients of LFA stabilized soil base/subbase material and comparison of these values to the design value, the effect of late-season construction of this stabilized material on its subsequent performance, and the development of autogeneous healing in this material. In addition, factors were identified to improve the performance of this material.

Nine existing pavements were tested with the falling weight deflectometer (FWD) and pavement coring was performed at each of those locations tested with the FWD. A computational procedure based on the 1993 AASHTO Guide for Design of Pavement Structures was utilized to determine the in-situ structural layer coefficient of the LFA stabilized soil base/subbase course materials. Intact LFA cores were tested for unconfined compressive strength. Three of the nine projects had both late season and subsequent construction season LFA stabilized material placed during the course of construction.

An extensive laboratory testing program was developed and implemented to further address the late-season construction issue and the relationship between compacted density and strength of LFA stabilized material.

All field and laboratory testing associated with this study has been completed.

Analyses of asphalt and LFA structural layer coefficients have been completed. Developed conclusions and recommendations based on these analyses and developed a power point presentation for the purpose of briefing MDOT personnel. It was determined that the average in-situ LFA stabilized soil base course structural layer coefficient was very close to the design value; however, the variation of the data will require a significant reduction in the design value for 85% reliability. Recommendations call for a significant increase in the required compacted density of LFA stabilized soil for base course construction, and field construction changes to reduce the variability in the spread of the water, lime and fly ash. An increase in the required level of pulverization of the blend was also recommended.

These conclusions and recommendations generated considerable discussion both within MDOT and with the contractors. A significant amount of time was expended addressing issues raised by both parties.

It was determined that the increase in the required level of compaction for the base layer requires a concurrent increase in the required level of compaction for the basement soil, design soil, and the chemically stabilized subgrade layer that collectively constitute the foundation for a given pavement structure. Recommendations were made to increase the required level of compaction for each of these pavement foundation components.

The effect of construction loading on partially cured LFA base layers was evaluated for different combinations of pavement layer configuration and moduli. The effect of long-term traffic loading was evaluated on completed pavement containing an LFA base layer. The Bisar computer program was used to facilitate these evaluations. The results of these evaluations were incorporated into a power point presentation and presented in a briefing to MDOT personnel. These evaluations substantiated MDOT's requirement for a chemically stabilized subgrade to support the overlying pavement.

Plans for FY 2003:

Continue to address issues and concerns of both MDOT and contractor personnel regarding this study. Publish a final report of the research conducted in this study.

Cost Estimate for FY 2003 \$20,377

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 15	STATE STUDY NO: 149
TOTAL STUDY BUDGET: \$52,600	TOTAL STUDY COST TO DATE: \$1,052
DATE STARTED: 10/01/01	COMPLETION DATE: 01/01/04
STUDY TITLE:	Development of a Transportation Kit for Elementary Students
RESEARCH AGENCY:	RIDES Inc. & Mississippi Department of Transportation - Human Resources Division
PRINCIPAL INVESTIGATOR:	William Sumrall

Objective:

The current available pool of qualified applicants for jobs in transportation is inadequate in meeting industry demands. It is estimated that this inadequacy will grow over the next 20-50 years. It is important to create an awareness of the field at the earliest age possible in order to adequately equip students with the academic skills necessary to enter the field. This study will involve the design of a program to increase elementary (K-6) students' awareness of career opportunities in the field of transportation and civil engineering. The program will address learning objectives across the curriculum including math, science, social studies, reading, music, art and history. Included in this study will be the development of a teachers' guide, a "transportation kit" and an age-appropriate video.

Progress:

The necessary contract documents were prepared and commission approval received to utilize the University of Mississippi as a consultant for this project.

Two writing teams met as a group bi-monthly and began the process of planning for and creating curriculum units focused upon increasing elementary (k-6) students' awareness of career opportunities in the field of transportation and civil engineering. Matching state and national standards for specific grade levels in math and science, consistent lesson plan formats, units topics, and interdisciplinary connection requirements were determined during these bi-monthly meetings. Progress was made toward developing the four-unit proposed set of curriculum units which include Transportation and Energy, Humans and Nature, Roadway Math and Future/Designing Ways.

Plans for FY 2003:

Complete the four curriculum units. Each unit will consist of 7-8 lesson plans around the respective unit that are designed for both k-3 and 4-6 grade levels. Each lesson within each unit will contain interdisciplinary activities that make connections to other subject areas.

Cost Estimate for FY 2003 \$51,548

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 16	STATE STUDY NO: 150
TOTAL STUDY BUDGET: \$95,386	TOTAL STUDY COST TO DATE: \$28,563
DATE STARTED: 10/01/01	COMPLETION DATE: 09/30/03
STUDY TITLE:	Automated Accident Detection at Intersections
RESEARCH AGENCY:	Mississippi State University Transportation Research Center
PRINCIPAL INVESTIGATOR:	Yunlong Zhang

Objective:

Traffic incidents cause over half of the highway delays to motorists. On urban surface streets, the majority of traffic accidents occur at or near intersections. This study will involve the collection of normal traffic sound signals at intersections, and the development of novelty detection algorithms to predict accident occurrences when abnormal acoustic signals associated with accidents are being recorded. Quick and accurate detection of an accident at an intersection is essential for the necessary medical and emergency response to be provided in a most timely manner. By shortening detection and notification time of the accident, along with reduced incident response time due to accurate incident information, the system can reduce the accident clearance significantly and therefore reduce congestion and delays.

Progress:

Literature in the area of accident detection was reviewed with the focus on the theories, algorithms and systems developed in the past concerning accident detection at intersections. Based on this literature review, the Wavelet theory, a powerful methodology for processing signal, images and other technical data and suitable for analyzing non-stationary signals such as traffic acoustic signal was chosen as the main analysis tool to recognize accident events from the background traffic events. Acoustic signal recording equipment items required for this study were obtained.

The traffic sound data collection was conducted to complete the acoustic database. The background traffic noise data were collected at different intersections in Jackson and in Starkville under different weather conditions.

A computer program in MATLAB software was developed to create a processing architecture for accident detection. After this program was completed, the known experiment data extracted from the acoustic database were used to perform a preliminary algorithm performance evaluation. Based this evaluation, the developed algorithms were modified accordingly.

Plans for FY 2003:

Continue detection algorithm testing, evaluation and refinement.

A preliminary implementation plan will be developed. To meet the requirements of real-time accident detection applications, detection and processing algorithms will be improved, especially in processing speed. Requirements on additional hardware and software for real-time implementation will be researched.

All required reports will be completed by January 31, 2003.

Cost Estimate for FY 2003 \$66,823

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 17	STATE STUDY NO: 151
TOTAL STUDY BUDGET: \$99,650	TOTAL STUDY COST TO DATE: \$22,361
DATE STARTED: 10/01/01	COMPLETION DATE: 09/30/04
STUDY TITLE:	Sample, Describe, and Map Yazoo Clay
RESEARCH AGENCY:	Mississippi Department of Transportation Materials Division
PRINCIPAL INVESTIGATOR:	Richard V. Martin

Objective:

The Yazoo Clay is notorious as a problem in Central Mississippi and in particular the Greater Jackson area. Its high-volume-change properties can have a devastating effect on roads, buildings, bridges, and embankments. The Yazoo Clay has never been studied systematically to determine what controls its properties and what is the distribution of these properties. All efforts have been local in nature and problem oriented. This study will seek to define the areal limits and stratigraphic units of the Yazoo Clay deposit based on engineering properties. These units can then be mapped showing the distribution of these engineering properties. A map showing this distribution will serve as a basis for designing solutions for projects located in a given unit. Also included in the study will be an analysis of how effective the current MDOT design policies with regards to Yazoo Clay have been and recommendations will be made as to any changes to the current policy that could be made.

Progress:

Holes were drilled under Site number 1864 to evaluate the upper Yazoo Clay, in Madison County to evaluate the middle Yazoo Clay and in Yazoo County to evaluate the lower part of the Yazoo Clay. Laboratory testing of samples taken from these holes have been conducted.

A search has been undertaken to find all of the historical geotechnical data related to the Yazoo Clay formation with the data being entered into an Access database. This data is on various paper files located in the MDOT Geotechnical warehouse and other published data. Map data is not available from the Mississippi Geological Survey. Basemaps have been created using GIS software so that both historical and new data can be viewed. A preliminary isopach map has been drawn of the Yazoo Clay and an initial subdivision of this clay by thickness has been completed.

Plans for FY 2003:

A detailed isopach map using well log data will be drawn. This will allow comparison of upper, middle, and lower Yazoo Clay properties using data gathered just for this project and historical data. Historical data will continue to be geo referenced and added to the data base.

Cost Estimate for FY 2003 \$33,000

MISSISSIPPI SPR-1(41)

PART II

LINE ITEM NO. 18

STATE STUDY NO: 152

TOTAL STUDY BUDGET: \$108,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/01

COMPLETION DATE: 09/30/03

STUDY TITLE:

Determination of the GeoGauge
Effectiveness in Measuring Stiffness and
Modulus Gain of Lime-Fly Ash
Stabilized Soil

RESEARCH AGENCY:

Mississippi Department of Transportation
Research Division

PRINCIPAL INVESTIGATOR:

William F. Barstis

Objective:

The GeoGauge is a hand-portable, non-nuclear, non-destructive testing device that directly and rapidly measures the stiffness of soils and soil-aggregate mixtures. The resulting stiffness measurements can be used to directly determine Young's modulus and shear modulus of the tested material. MDOT is participating in the SPR-2 (212) GeoGauge Pool Fund Study. MDOT has been asked to participate in Research Task 3D "Determination of the GeoGauge effectiveness in measuring strength gain of chemically-stabilized soils and bases". MDOT has constructed over 100 projects during the past 15 years involving the use of Lime-Fly Ash (LFA) stabilized soil for base and subbase pavement layers. This proposed study addresses MDOT's research efforts supporting Task 3D by evaluating the stiffness and modulus gain of this commonly used construction material. Characterizing the modulus of this material in a rapid manner is necessary for use in the mechanistic/empirical flexible pavement design procedures being reviewed for adoption in the 2002 AASHTO Guide for Design of Pavement Structures.

Progress:

Became familiar with the procedure to check the geogauge with the verification mass.

Performed a limited number of geogauge tests in conjunction with FWD and ADCP field testing on test sections associated with SS 153 – "Falling Weight Deflectometer for Estimating Subgrade Moduli."

No significant progress was made during FY 2002. Several problems with geogauges render data obtained from them to be questionable, and these need to be rectified before MDOT can proceed with this study. A GeoGauge Pooled Fund Study Technical Working Group met June 17th and 18th of 2002 and a conference call was conducted July 12th of 2002. Geogauge seating issues, repeatability of multiple measurements concerns and determination of geogauge zone of influence and limitations on use based on material type, are a few of the topics discussed at these events.

Plans for FY 2003:

The plans are dependent upon resolving problems with the Geogauge.

Cost Estimate for FY 2003 \$20,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 19	STATE STUDY NO: 153
TOTAL STUDY BUDGET: \$122,675	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/01	COMPLETION DATE: 12/31/03
STUDY TITLE:	Falling Weight Deflectometer for Estimating Subgrade Moduli
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	K.P. George

Objective:

Characterizing the subgrade in terms of resilient modulus (M_r) is essential for AASHTO pavement design/evaluation. Due to the complexity of the laboratory M_r test procedure, highway agencies have been exploring Non Destructive Tests (NDT), such as the Falling Weight Deflectometer, (FWD), to determine the M_r of a given material. In this study, four test sections with subgrade reflecting a range of soil types (fine- and coarse- grain soils) will be tested with FWD measurements obtained directly on the prepared subgrade. Shelby tube samples of subgrade material will be obtained for laboratory M_r testing and Dynamic Cone Penetrometer (DCP) field testing will be conducted. Either a modification to a currently existing backcalculation routine, or a completely new FWD backcalculation program, will be developed for this study. Current backcalculation routines have been developed for layered pavement systems where each layer, except for possibly the subgrade, are modeled for linear moduli behavior. The subgrade consists of one or more non-linear behaving soil layers. This modified/new backcalculation program will be capable of handling a system of multiple layers where each layer can be modeled for non-linear behavior. Employing this modified/new backcalculation program, M_r of the subgrade layers will be calculated and compared first with the laboratory M_r values and second with the M_r values derived from the DCP index. The results will be statistically analyzed exploring how closely the FWD-backcalculated values agree with the laboratory M_r values. The M_r -DCP index relationship, recently derived in State Study # 131, will also be substantiated. This proposed study fundamentally differs from SS #131 in that the FWD test apparatus, equipped with a much larger plate than that used in the previous study or used for routine FWD pavement testing, is the field testing equipment being employed for modulus characterization. The need for a larger plate was determined in the previous study during field testing directly on untreated subgrade. In this previous study, the Automated DCP was the primary field testing equipment evaluated for modulus characterization. In summary, this proposed study offers another, potentially more accurate and faster, method of subgrade characterization for pavement design.

Progress:

A literature review was conducted which focused on the subject of FWD testing on pavements and subgrades. Methods of calculating subgrade modulus from FWD deflection data were investigated.

Three test sections were tested in April using the FWD, ADCP, geogauge and nuclear gauge. Shelby tube samples were obtained. Both the 300mm and the 450mm plates were used in conjunction with the FWD testing on two of the sections. Large variations in material properties with depth were encountered. Due to these variations, both subsequent sets of three sections had exploratory testing performed with the ADCP prior to FWD testing and sample extraction to ensure uniformity with depth.

The testing for the second set of three sections was conducted with both plate sizes and modified sensor tips. Large tips of 16mm replaced the 10mm tips.

The testing for the third set of three sections was conducted with both plate sizes and both tip sizes were used when testing with the 300mm plate.

Elastic calculations were performed. Laboratory resilient modulus tests on core samples were completed. FWD deflection-based modulus was correlated to the laboratory modulus.

Richard Stubstad of ERES Consultants was retained as a consultant, especially to provide technical advice during the data analysis phase.

A subsequent single test section was tested to serve as a verification of the models developed from data obtained in the previous test sections.

Plans for FY 2003:

15 resilient modulus values are obtained from each resilient modulus test (three confining stresses at five deviatoric stresses each). An evaluation will be made regarding the selection of a modulus value that can be related to the modulus value obtained from FWD tests.

Evaluate the extraction of a representative modulus value from the FWD test.

After the issues regarding selection of moduli values are resolved, the focus of the research will be in correlating these two sets of values.

Check the models with data from the last single test section tested in August of 2002.

Cost Estimate for FY 2003 \$47,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 20	STATE STUDY NO: 154
TOTAL STUDY BUDGET: \$32,000	TOTAL STUDY COST TO DATE: \$12,565
DATE STARTED: 10/01/01	COMPLETION DATE: 03/31/04
STUDY TITLE:	In-House Support to State Study 153
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

Objective:

This study is being proposed to support the proposed study "Falling Weight Deflectometer for Estimating Subgrade Moduli". Most of the field testing to support the contract study will be conducted by this in-house study. Engineering time is also allocated for reviewing the draft and final report copies submitted by the Principal Investigator of the contract study.

Progress:

Performed FWD, automated DCP, manual DCP and geogauge testing on ten test sections. Burns, Cooley, Dennis Inc. was used to obtain undisturbed Shelby tube samples and nuclear gauge testing at these test sections.

Plans for FY 2003:

Provide support as required to the Principal Investigator of this study.

Cost Estimate for FY 2003 \$2,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 21	STATE STUDY NO: 155
TOTAL STUDY BUDGET: \$115,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/01	COMPLETION DATE: 09/30/04
STUDY TITLE:	Use of Asphalt Pavement Analyzer to Study In-Service Asphalt Mixture Performance
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Tom White

Objective:

Aggregates and their combination into mixture gradations are significant variables affecting the rutting potential of an asphalt mixture. Because aggregates vary from state to state, it is important to evaluate Asphalt Pavement Analyzer (APA) rutting criteria for local aggregates. Another issue is whether laboratory compaction will produce test specimens with the same magnitude of rutting as field compacted specimens. This study addresses both of these issues. Cores will be taken from in-service pavements for APA testing and for extraction to determine asphalt content and aggregate gradation. Specimens with the same gradation and asphalt grade and content will be prepared, compacted and tested in the APA using aggregates obtained from the same sources as used in the in-service pavements. An analysis will be conducted to determine if there are differences in rutting of field and laboratory compacted specimens. Appropriate APA rutting criteria will be recommended for asphalt mixtures utilizing aggregates available in Mississippi.

Progress:

A meeting with MDOT Research and Materials Divisions was held and a finalized test matrix was decided upon.

Plans for FY 2003:

Project work will consist of identifying candidate hot mix asphalt sections, obtaining mix design and QC/QA data for each project, conducting field coring, and evaluating the mixtures in the laboratory. The laboratory work will consist of correlating in-place density of cores to the amount of traffic on the facility while evaluating the rutting susceptibility of the mixes with the Asphalt Pavement Analyzer. A relationship between laboratory APA rutting and applied traffic will be determined and appropriate rut criteria developed for MDOT.

Cost Estimate for FY 2003 \$50,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 22	STATE STUDY NO: 156
TOTAL STUDY BUDGET: \$20,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/01	COMPLETION DATE: 09/30/03
STUDY TITLE:	Bridge Deck Cracking
RESEARCH AGENCY:	Mississippi Department of Transportation Materials Division
PRINCIPAL INVESTIGATOR:	Mike O'Brien

Objective:

There is a nationwide problem with concrete bridge deck cracking. Drying shrinkage of reinforced concrete creates cracks, which allow moisture and salts to infiltrate around the reinforcing steel. The moisture and salts accelerate the deterioration of the structure through corrosion of this reinforcement. In this study the drying shrinkage of concrete mixes, blended with different materials and admixtures, will be measured. The quantification of this shrinkage will aid in identifying a maximum allowable drying shrinkage for bridge deck construction.

Progress:

Drying shrinkage concrete prism samples were cast using ASTM C157 specification requirements. All concrete mixes are of the same source of cement and have a total cementitious content of 564 lbs. The mixes were adjusted for volume by increasing the fine aggregate content. Water content was adjusted to yield the same consistency (slump). All concrete samples were moist cured for 28 days, then measured with a length comparator, and finally subjected to drying conditions of 100 °F at 50% RH for a 60-day period.

Samples were cast using "Eclipse", which is a concrete admixture made specifically for reducing the drying shrinkage of concrete. Sets were also made with Type A water reducer, which is a high-range water reducer, and one set was made where 25% of the Portland cement was replaced with a Class C fly ash.

Shrinkage samples were cast using low specific gravity chert from North Mississippi, chert gravel from Mississippi coast sources which are shy of aggregate sizes between the ½ and 1" sieve sizes, and size 57 limestone from Kentucky. Three sets were made of varying coarse aggregate content. A total of 14 different concrete mix designs are being evaluated for shrinkage.

Plans for FY 2003:

The drying shrinkage of the concrete prism samples will be measured and a report written. The mix design with the least shrinkage will be used on a bridge deck and an evaluation made on cracking.

Cost Estimate for FY 2003 \$19,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 23	STATE STUDY NO: 157
TOTAL STUDY BUDGET: \$150,000	TOTAL STUDY COST TO DATE: \$102,445
DATE STARTED: 03/01/02	COMPLETION DATE: 09/30/04
STUDY TITLE:	Evaluation of DRM System
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATORS:	John Avent & William Barstis

Objective:

Reflective cracking in flexible pavements is a primary form of distress found in Mississippi highway pavements. To date, few if any, fail safe preventative measures to prevent this distress have been discovered.

The objective of this project is to evaluate an interlayer system, DRMTM (Distress Resistant Membrane), as a preventative treatment for reflective cracking in HMA pavements. (More information on the DRMTM system can be found at <http://www.highwaypreservation.com>) A seven mile long project on MS4 near the community of Galena in Marshall County will be utilized for the evaluation. MS4 near Galena was originally constructed in 1981 and is comprised of 6" of asphalt pavement on top of a soil cement base. Reflective cracking from the soil cement base has caused the pavement condition to become unacceptable.

The study will compare 3½ miles of DRMTM with a subsequent 4" overlay to 3½ miles of no DRMTM with a 4" overlay. A comparison will be made between the amount of reflective cracking in the new 4" overlay between the sections with and without the DRMTM system.

Progress:

The 3½ mile DRMTM section was constructed in May of 2002 and subsequently overlaid with 2 lifts of HMA. Monitoring performance of this section was initiated.

Plans for FY 2003:

Continue monitoring DRM section performance.

Cost Estimate for FY 2003 \$10,000

PART II

LINE ITEM NO. 24	STATE STUDY NO: 158
TOTAL STUDY BUDGET: \$110,404	TOTAL STUDY COST TO DATE: \$1,920
DATE STARTED: 06/01/02	COMPLETION DATE: 09/30/04
STUDY TITLE:	Port Sedimentation Solutions
RESEARCH AGENCY:	Mississippi State University, Ports & Waterways, Research Division Mississippi Department of Transportation
PRINCIPAL INVESTIGATORS:	William H. McAnally

Objective:

The purpose of the investigation is to determine if there are feasible, affordable engineering solutions to reduce or eliminate dredging requirements at docks and mooring areas at the Mississippi public ports on the Tennessee-Tombigbee Waterway, and to compare feasible solutions to public purchase and operation of a dredge.

Progress:

Authorization to proceed was received on 3 June 2002. Six public ports on the Tennessee-Tombigbee Waterway and the Corps of Engineers Area Office were visited to seek information on the types, location, and volumes of sediment accumulating within the port boundaries, plus any other information that the port directors believed to be important. Background information was obtained regarding the waterway, flow data, and maps of the region. Specific activities included:

1. Literature Review

Publications describing the construction of and the problems faced by the Tenn-Tom Waterway were reviewed, with the focus on sedimentation. Previous studies on environmental aspects of the Waterway performed by MSU were obtained, including data files for computer models.

2. Port Visit Summary

Visits were made to each of the six public ports on the Waterway. The primary purposes of visiting the port authorities were to introduce the project and personnel involved in this study, and to inspect the ports. The port representatives were also asked to provide available data on the physical properties of the port and waterway. During these port visits photos were taken, physical observations recorded, and three sediment samples collected for visual inspection. The ports provided information, typically including:

- Maps of ports showing facilities and geographic features;
- Contact information of other knowledgeable persons;
- Location and size of dredged material disposal area;
- Current sediment problems;
- Channel profiles.

2. Data Gathering

In addition to the information provided by the ports, the Corps of Engineers Tenn-Tom Waterway Management Office was visited to obtain data and consultation was made with the Corps' Mobile District staff by phone.

3. Research Plan

After reviewing the relevant literature, studying past research efforts on the Tennessee-Tombigbee Waterway focusing on modeling and sedimentation, work began on development of detailed plans for the balance of the research. Hypotheses were formulated on the sediment transport mechanisms for each port and possible engineering solutions for the sedimentation problems. These hypotheses will be used to design the data collection and analysis plan.

The main tasks for the last quarter of FY 2002 included:

- Selected in consultation with MDOT the ports on which to focus
- Determined specific data requirements and acquired additional data
- Updated port authorities on progress
- Started developing model for channel flow simulation
- Conducted preliminary data analysis.

Plans for FY 2003:

Deliver a Phase I report providing preliminary evaluation of Tenn-Tom Waterway public port sedimentation problems and possible engineering solutions.

Develop and provide a Phase II feasibility design for engineering solutions for a subset of the six public ports.

Compare recommended engineering solutions with the option of a publicly owned and operated dredge.

Cost Estimate for FY 2003 \$83,000

PART II

LINE ITEM NO. 25	STATE STUDY NO: 159
TOTAL STUDY BUDGET: \$60,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/02	COMPLETION DATE: 09/30/04
STUDY TITLE:	In-House Support to State Study No. 155
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	James Watkins

Objective:

This study will be conducted to support State Study No. 155 "Use of Asphalt Pavement Analyzer to Study In-Service Asphalt Mixture Properties" which is under contract with the Department of Civil Engineering at Mississippi State University. The field site locations, layout, and sampling to support the contract study will be conducted by this in-house study.

Progress:

No progress to date

Plans for FY 2003:

Provide support as required by the principal investigators of State Study No. 155. This support will include coring, traffic control, pavement management data retrieval and any other related departmental support necessary for the completion of State Study No. 155.

Cost Estimate for FY 2003 \$50,000

PART II

LINE ITEM NO. 26	STATE STUDY NO: 160
TOTAL STUDY BUDGET: \$20,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/02	COMPLETION DATE: 09/30/03
STUDY TITLE:	In-House Support to Zinga™ Demonstration Project
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	Johnny Hart

Objective:

This study will be conducted to support the Innovative Bridge Research and Construction Project, "Zinga™ Demonstration Project" (FHWA Project No. IRBC 0026-01(35) & MDOT Project No. IBRC-110-01(22)) under contract with Consolidated Products Inc. All MDOT documentation of the demonstration project will be funded through this support study.

Progress:

No progress to date

Plans for FY 2003:

Provide support as required by the contractor of the Zinga™ Demonstration Project.

Cost Estimate for FY 2003 \$20,000

LINE ITEM NO. 27

STATE STUDY NO: 161

TOTAL STUDY BUDGET: \$125,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 06/30/03

STUDY TITLE:

Purchase SuperPave Equipment for the
Department of Civil Engineering at Jackson
State University

RESEARCH AGENCY:

Mississippi Department of Transportation
Research Division
Jackson State University

PRINCIPAL INVESTIGATOR:

Randy L. Battey

General Information:

The use of Superpave (Superior Performing Asphalt Pavement) hot mix asphalt, designed for improved and longer lasting pavements, is strongly recommended by the FHWA and has been fully adopted by MDOT for construction of new highways and rehabilitation of existing highways. The Superpave system is currently used for design and quality control of all MDOT hot mix asphalt projects.

Objective:

Recognizing that the engineering institution at Jackson State University does not have SuperPave equipment, MDOT has elected to provide a set of standard SuperPave equipment to this institution. It is also noted that similar equipment was purchased via State Study No. 135 for the engineering institutions at Mississippi State University, the University of Mississippi and the engineering technology program at the University of Southern Mississippi. It is MDOT's objective to ensure that the civil engineering and engineering technology graduates hired are knowledgeable of SuperPave technology.

Products:

In return for providing the test equipment, Jackson State University has provided the following information:

List of equipment to be purchased:

SuperPave Gyratory Compactor
Rotational (Brookfield) Viscometer
Dynamic Shear Rheometer
Bending Beam Rheometer
Rolling Thin Film Oven
Pressure Aging Vessel

Plan by the University for the utilization of the equipment in the civil engineering curriculum:

The Department of Civil Engineering is committed to enhance its curriculum by including the SuperPave instructional materials in the civil engineering courses "CIV 390 Fundamentals of Transportation Engineering" and "CIV 475 Pavement Design" The equipment will also be used for research.

A description of the laboratory space that will be dedicated to house the equipment:

The equipment will be housed in the "Structures and Materials Laboratory", which is located in the J.Y. Woodard Building. This building is situated on the main campus of the Jackson State University and is equipped with the necessary facilities and instruments for testing various materials and structural members.

The number of students anticipated to be enrolled in the applicable course work during the school year:

It is anticipated that approximately 6 to 8 students will be enrolled in the course work. This number is expected to increase in the long term.

The number of instructors who will be using the equipment and need to be trained:

One instructor will use the equipment. Dr. Hak-Chul Shin, P.E., assistant professor in the Department of Civil Engineering is currently a faculty member with specialization in transportation engineering and pavement design.

This is the only information required from Jackson State University. There are no deliverables and no final reports required.

Cost Estimate for FY 2003 \$125,000

LINE ITEM NO. 28

STATE STUDY NO: 162

TOTAL STUDY BUDGET: \$35,719

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 09/30/03

STUDY TITLE:

Research on Potential Applications of the Static and Dynamic Cone Penetrometers for MDOT Pavement Design and Construction

RESEARCH AGENCY:

Jackson State University

PRINCIPAL INVESTIGATOR:

Farshad Amini

Objective:

There have been some studies on the potential use of the dynamic cone penetrometer (DCP) for evaluation of the pavement distress state; however, there is a need for evaluating the extent of applications of the DCP for pavement design and construction. An example of such an application for pavement design is obtaining subgrade resilient moduli values, the research topic addressed in SS No. 131 entitled "Subgrade Characterization for Highway Pavement Design." Similarly, a comprehensive study of the application of the static (Dutch) cone penetrometer to pavement design is also lacking. This study is directed toward providing MDOT with information for the use of both types of penetrometers for design and construction. The proposed study will be conducted in response to a request by the Second District to determine and evaluate other potential applications of the DCP and in response to a request by MDOT's Assistant Chief Engineer of Pre-Construction to determine and evaluate potential applications of the static cone penetrometer. Potential applications include the use of these penetrometers for QC/QA of in-situ lime-fly ash base course material quality and layer thickness.

It is planned that this project be performed in two phases. Phase I will be completed during FY 2003 with the objective to perform a literature review so that a recommendation for the type and number of tests (if any) can be made. Phase II will include the required laboratory and field testing as determined in Phase I.

Cost Estimate for FY 2003 \$35,719

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 29

STATE STUDY NO: 163

TOTAL STUDY BUDGET: \$14,715

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 09/30/03

STUDY TITLE:

Develop Mississippi DOT's Plan to Implement the 2002 Design Guide

RESEARCH AGENCY:

ERES Consultants Division of Applied Research Associates, Inc.

PRINCIPAL INVESTIGATORS:

Athar Saeed
Jim Hall

Objective:

The 2002 AASHTO Design Guide uses mechanistic-empirical (ME) principals for pavement design and is different from existing empirical procedures. The 2002 Guide includes performance models calibrated and validated using data from the Long Term Pavement Performance (LTPP) program.

A calibration-validation process ensures that the conceptual model is a reasonable representation of the real world. The 2002 Guide calibrated and validated using LTPP data at the national level will likely require modifications for local conditions, materials and climate. Small differences in maintenance strategies, construction practices, material specifications, etc., due to local preferences can cause large performance differences. MDOT is planning to implement the 2002 Guide. Calibrating and validating the 2002 Guide using Mississippi performance data will ensure that the resulting pavement designs are locally attuned.

This research will develop a plan for implementation of the 2002 Guide for MDOT including:

Evaluate adequacy and suitability of national performance models for Mississippi conditions

Develop an experimental design (factorial) to consider potential performance related factors

Identify Mississippi test sections in the LTPP program and other Mississippi test sections that provide data to locally calibrate and validate performance models

Assemble necessary data from selected test sections

Adjust national performance models for Mississippi conditions using appropriate data

Validate performance models calibrated for Mississippi conditions

Develop a technology transfer procedure and personnel training program for MDOT

Estimate costs associated with implementation of the 2002 Guide

The proposed research is phase I of a two-phase research approach. The proposed research will only develop the plan for implementing the 2002 Guide for MDOT and will not conduct any of the implementation tasks. Based upon the conclusions of phase I, phase II will be developed and proposed for subsequent approval.

Cost Estimate for FY 2003 \$14,715

PART II

LINE ITEM NO. 30

STATE STUDY NO: 164

TOTAL STUDY BUDGET: \$45,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 09/30/03

STUDY TITLE:

Real – Time Implement of an Intersection
Accident Detection System – Phase I

RESEARCH AGENCY:

Mississippi State University

PRINCIPAL INVESTIGATOR:

Yunlong Zhang

Objective:

The current MDOT-sponsored project being conducted at MSU, State Study No. 150 entitled “Automated Accident Detection at Intersections” has produced accident detection algorithms to detect accident events from the ambient sound signals. The proposed project is intended to implement these algorithms in a real-world system. Based on cost, performance, reliability and scalability, the optimal system architecture will be decided and designed. The system will include four modules performing the functions of acoustic signal collection, digital signal processing, data transmission and accident reporting. The proposed project will include two phases. Phase I is expected to require four to five months for completion. In this phase the following tasks will be performed:

Conduct a literature review to obtain the latest information on real-time accident detection, related instrument technology and protocols for DSP and communication hardware

Survey state transportation agencies to learn about the existing facilities such as the detection equipment, the communication networks and the computer networks

Determine the final system architecture and specifications of all system components, including the requirements and specifications of communication links, processors at intersections, and either the active sensor’s DSP hardware or the central server

Phase II of the study will be the implementation of the real-time system. The choice of the final system architecture implemented in this phase depends upon the results of Phase I; therefore, the necessary funding for Phase II will be determined at the conclusion of Phase I.

Cost Estimate for FY 2003 \$45,000

MISSISSIPPI SPR-1(41)

PART II

LINE ITEM NO. 31

STATE STUDY NO: 165

TOTAL STUDY BUDGET: \$40,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 12/31/03

STUDY TITLE:

Traffic Load Spectra Development for the
2002 AASHTO Design Guide

RESEARCH AGENCY:

Mississippi State University

PRINCIPAL INVESTIGATOR:

Shane Buchanan

Objective:

The current AASHTO structural pavement design guide utilizes design traffic input in terms of equivalent single axle loads (ESALS). The traffic input for the new 2002 AASHTO Guide for Design of New and Rehabilitated Pavement Structures will be in terms of load spectra. Load spectra is a change from ESAL calculation and consists of classifying the traffic loading in terms of the number of load applications of various axles configuration (single, dual, tridem and quad) within a given weight classification.

Load spectra analysis is conducted by counting, classifying, and weighing vehicles for a given time period. The design traffic (load spectra) for the pavement design life can then be calculated in a similar manner as currently used for ESALs, through the application of a traffic growth factor based on historical and anticipated traffic on the facility.

The focus of the study will be to determine how the existing traffic information gathered by MDOT can be used to determine load spectra information. A number of roadway types (two-lane, four-lane and interstates) will be evaluated. Traffic volume and distribution data will be reviewed and load spectra developed for each site. Assistance with traffic data collection will be given to MDOT, if necessary, to insure accurate load spectra development. The final report will provide a clear, easy to follow methodology for developing load spectra from traffic volume and distribution data.

Cost Estimate for FY 2003 \$30,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 32

STATE STUDY NO: 166

TOTAL STUDY BUDGET: \$110,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 09/30/04

STUDY TITLE:

Hot Mix Asphalt (HMA) Characterization for
the 2002 AASHTO Design Guide

RESEARCH AGENCY:

Mississippi State University

PRINCIPAL INVESTIGATOR:

Shane Buchanan

Objective:

MDOT currently uses the AASHTO Guide for the Design of Pavement Structures for structural pavement design. This guide is empirically based and utilizes the concept of structural numbers (SN) to determine the overall required thickness of varying pavement layers. These structural numbers were determined from the AASHTO road test in the 1950's.

Currently the AASHTO 2002 Guide for Design of New and Rehabilitated Pavement Structures is being developed. This guide will have three design levels (Level 1,2 and 3) all based on mechanistic-empirical design principles and will potentially replace the existing guide as the structural design guide for MDOT.

The researchers working on the flexible pavement component of the 2002 guide have evaluated many test methods to determine the best relationship between observed HMA mix lab performance and field performance with respect to rutting, fatigue cracking, etc. Currently, the dynamic modulus test will be used to characterize HMA mixes for input into the 2002 design guide. The test is run in accordance with ASTM D 3497 Standard Test Method for Dynamic Modulus of Asphalt Concrete Mixtures.

Mississippi HMA mixes need to be characterized using dynamic modulus testing in preparation for the future implementation of the 2002 design guide. In this study a range of HMA mixes will be characterized using the dynamic modulus testing. Any proposed evaluation will initially be focused on materials and mixes that are currently being used in the state.

Selected mixes will also be evaluated using the asphalt pavement analyzer (APA) and confined repeated deformation testing for comparison purposes. MDOT has performed APA testing on many mixes and a side-by-side comparison of the dynamic modulus and the APA would be very useful.

Cost Estimate for FY 2003 \$55,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 33

STATE STUDY NO: 167

TOTAL STUDY BUDGET: \$90,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 09/30/04

STUDY TITLE:

Laboratory Accelerated Stripping Simulator
(LASSi) for Hot Mix Asphalt (HMA)

RESEARCH AGENCY:

Mississippi State University

PRINCIPAL INVESTIGATOR:

Shane Buchanan

Objective:

The complex mechanism of stripping can be simply defined as a loss of bond between the mineral aggregate and the asphalt binder in the presence of water. The result is a shear strength loss in the pavement, which can lead to rutting and cracking. It is generally recognized that stripping is related to three factors: 1) traffic, 2) water, and 3) high in-place service temperatures.

Currently, MDOT is using two different methods to evaluate moisture resistance. These include MT-63: Resistance of Bituminous Paving Mixtures to Stripping (Vacuum Saturation Method) and MT-59: Determination of Loss of Coating of HMA (Boiling Water Test). The MT-63 test requires in excess of 24 hours to complete and includes a visual examination to determine the amount of visual stripping of the asphalt cement from the aggregate along the failure plane following the indirect diametral tensile test. The MT-59 test relies on visual examination to evaluate the amount of stripping present in uncompacted material.

The proposed study is designed to evaluate a test method that utilizes the Laboratory Accelerated Stripping Simulator (LASSi) that is designed to condition a compacted HMA sample, either laboratory prepared or field core, in a manner that closely simulates the stripping mechanism that occurs in the field when the pavement structure is exposed to water, repeated loading, and elevated in-place service temperatures. This is accomplished by subjecting the test specimen to alternating pressure and vacuum stages thus forcing water to correspondingly move in two opposite directions through the specimen. It is anticipated that conditioning of the sample in this manner can be completed within one hour or less as opposed to the 24-hour conditioning time when using the MT-63 test procedure.

This study includes several phases. In the first phase, mixes comprised of 100 percent gravel, 50/50 gravel and limestone, 100 percent limestone and 100 percent granite will be evaluated using the LASSi device along with conventional MDOT procedures (MT-63 and MT-59). The results will be used to determine if the LASSi device can delineate potentially moisture susceptible mixes. Additionally, this testing will allow for the testing protocol of the device to be refined.

The second phase of the study will be to evaluate the effect of selected mix parameters (e.g., asphalt content, gradation, anti-stripping additives, polymer modifier type, etc.) on the moisture resistance of the various mixes.

At least five constructed mixes that have shown premature moisture damage will be reproduced in the laboratory and evaluated using the various moisture conditioning procedures. These are mixes that have successfully passed the conventional moisture conditioning tests used by MDOT. By completing this work, the ability of the LASSi device to better predict moisture susceptible mixes will be determined.

A major advantage of this proposed test method is the ability to quickly evaluate (1 hour or less) the moisture susceptibility of plant produced HMA mix as opposed to a minimum of 24 hours when using the MT-63 test procedure. This is a significant factor when considering a test for QC/QA of HMA when a contractor can produce 300 tons of HMA per hour, or 3000 tons in ten hours.

Cost Estimate for FY 2003 \$45,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 34

STATE STUDY NO: 168

TOTAL STUDY BUDGET: \$50,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 03/31/04

STUDY TITLE:

Field Tack Coat Evaluator (AtackerTM)

RESEARCH AGENCY:

Mississippi State University

PRINCIPAL INVESTIGATOR:

Shane Buchanan

Objective:

A variety of materials (emulsions, asphalt cements, etc.) can successfully be used for tack coats for hot mix asphalt (HMA) pavements. However, in many cases, bond loss between pavement layers is evident in the form of pushing and shoving even though tack coats were applied. Bond loss can occur for many reasons; some of which are 1) emulsion not breaking prior to overlay, 2) emulsion dilution, 3) too little or too much tack coat applied, 4) material (primarily dust) covering the tack coat prior to overlay, 5) old tack coat materials being used which have lost some adhesive properties.

The “ideal” application rate will likely vary between different tack coat materials. The key is to determine that rate and set specification targets and tolerances accordingly. Laboratory tack coat evaluations can be used to determine acceptable tack coat materials and rates. However, the real and ultimate measure of the tack coat performance should be determined in the field so that environmental, construction, and other factors are considered. Currently, a device referred to as the AtackerTM, is being developed to measure the asphalt tack coat shear resistance in the field. The unit can be calibrated against different strength tack coats and will automatically indicate a relative strength. Agencies can specify required strengths based on known and acceptable coating materials.

This study will consist of a laboratory and a field study. The laboratory portion will determine appropriate operational parameters of the AtackerTM and baseline results when evaluating standard tack coat materials and methods meeting current MDOT specifications. The effect of tack coat application rate, pavement surfaces type (concrete and asphalt), and pavement surface conditions will be evaluated as a minimum.

The field study will consist of evaluating a minimum of 12 to 15 construction projects to determine the relationship between the laboratory-measured properties and the field properties. The evaluated projects will be selected to provide similar variables as the laboratory evaluation such as different pavement surfaces type (concrete and asphalt), tack coat application rate, pavement surface conditions (new, oxidized, milled, etc.). Individual relationships will be developed for the various construction variables. Additionally, the interaction of variables will be evaluated to determine the most significant effect(s) on tack coat bond strength.

The AtackerTM will provide MDOT with a field method to evaluate tack coat materials and application methods. MDOT can specify required strengths based on known performance

and acceptable tack coating materials. This device will help ensure materials used are consistent and meet the required specification.

Cost Estimate for FY 2003 \$34,000

MISSISSIPPI SPR-1(41)
PART II

LINE ITEM NO. 35

STATE STUDY NO: N/A

TOTAL STUDY BUDGET: \$25,000

TOTAL STUDY COST TO DATE: \$0

DATE STARTED: 10/01/02

COMPLETION DATE: 09/30/03

STUDY TITLE:

Minor Research Studies

RESEARCH AGENCY:

Mississippi Department of Transportation
Research Division

PRINCIPAL INVESTIGATOR:

Randy L. Battey

Low cost/short duration projects may be done without being put into a process of clearances and competing with other programs. An example of such a project is an experimental feature evaluation.

The Research Advisory Committee will establish a resource threshold to be met before requiring any project be put into a centralized clearinghouse/priority setting process. Current operating procedures are to conduct research projects where the expenditure ceiling is expected to be under \$10,000 and the project duration is expected to be one year or less.

These are based on selection and approval by the Research Engineer, following an appropriate review of District needs and literature review.

These research projects are short-term, and will employ only MDOT personnel in the research project. Brief, concise work plans will be developed for each of these projects.

Cost Estimate for FY 2003 \$25,000

MISSISSIPPI SPR-1(41)
PART II

MISSISSIPPI PARTICIPATION IN NCHRP

The Mississippi Department of Transportation contributes to the National Cooperative Highway Research Program (NCHRP). NCHRP is a special-purpose program administered by the Transportation Research Board (TRB) under a three-way agreement among the National Academy of Sciences, AASHTO, and the FHWA. Funding is provided by state highway and transportation agencies at a rate of 5.5% of the agencies' SPR funds. Funds for this participation are 100% Federal and thus contain no state match. These pooled funds are used to fund research aimed at solving national or regional problems and can only be spent on problems approved by at least two-thirds of the states. Formal solicitations are made from the states, AASHTO committees, TRB committees and FHWA to develop problem statements. Estimated contribution for FY 2003 is **\$359,200.**

MISSISSIPPI SPR-1(41)
PART II

TRANSPORTATION RESEARCH BOARD CORRELATION SERVICE

This service provides for subscription to a "Research Correlation Service" from the Transportation Research Board, a service established and operated in accordance with the recommendation of the Executive Committee of AASHTO. The activities supported by this subscription include the collection of available information concerning past, current and proposed research related to transportation from all sources including federal, state and other government agencies, colleges and universities, research and planning organizations, transport operators and industry, as well as the TRB Annual Meeting and conference programs; the study and correlation of this information through the work of the committees of the Board and dissemination of the useful findings of research and other information by all feasible means including the several TRB publication series, the output of the Transportation Information Services, and through personal contacts during scheduled field visits by the TRB professional staff. The FY 2003 TRB Correlation Service is funded for \$86,740, which corresponds to the current annual subscription cost for Mississippi.

Cost Estimate for FY 2003 \$86,740

POOLED FUND STUDIES

Pooled Fund Study: *Auburn University Accelerated Pavement Test Facility - Round 2*

Host Agency - Alabama Department of Transportation

The objective of this pooled-fund study is to continue to operate, and analyze the data from Mississippi's existing two sections on the NCAT test track and to construct an additional section utilizing a 4.75mm SuperPave mix design. Nine states (Alabama, Florida, Georgia, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, and Tennessee) are currently committed to participate in this study that will evaluate hot mix asphalt pavement under an additional traffic loading of 10 million equivalent single axle load (ESALs) over a three year period. This will result in a total traffic loading on MDOT's existing two sections of 20 million ESALs. Each participating state will be responsible for the pavement design for any new test sections. The National Center for Asphalt Technology (NCAT) will be responsible for monitoring the experiment to include periodic data collection and data analysis. The MDOT has committed to the second round of test section construction, trafficking and analysis. This commitment will be for fiscal years 2003 through 2005 in the following amounts:

FY 2003 - \$170,000 FY 2004 - \$170,000 FY 2005 - \$170,000

Pooled Fund Study: *Southeast SUPERPAVE Center*

Host Agency - Alabama Department of Transportation

The objective of this pooled-fund study will be to support the implementation of the products of the SHRP research effort within the state DOTs through the ***Southeast SUPERPAVE Center***. Each state can select from a list of services that will best satisfy their needs. The list includes:

- Develop and provide, for the DOTs and Industry, training on the volumetric analysis of HMA pavements using the Superpave Gyratory Compactor.
- Conduct at least 1 (more if needed) four day Superpave binder school at NCAT.
- Provide troubleshooting expertise to the states on the development of Superpave designs - both over the phone and as required by visits to the DOT laboratory and/or project site.
- Provide support for implementation of Superpave by conducting round robin studies to evaluate the accuracy of laboratories within the region.

If additional work is needed, each state can determine from the list of services the cost for performing this additional work.

FY 2003 - \$20,000

Pooled Fund Study: **LTPP SPS8 WIM Calibration and Data Processing**

Host Agency - FHWA

The Long Term Pavement Performance (LTPP) Program was initiated as a part of the Strategic Highway Research Program in 1987. The intent was a 20-year study of pavements that would provide the highway community with the information it needed to design, build and maintain cost-effective and long lived pavements. Mississippi is one of 37 states and provinces participating in the LTPP Specific Pavement Studies (SPS). A core objective of these studies is to quantify relationships between pavement performance, truck volumes and axle loading. It is essential to quantify these relationships if we are to make progress in improving our ability to predict the long-term performance of our Interstates and other major highways. Unfortunately, the states and provinces have fallen behind in collecting the required traffic data and successful achievement of this goal is in serious jeopardy. The Transportation Research Board's LTPP Committee, which oversees the program on behalf of the states and provinces, has concluded that the current traffic data collection provided by the states and provinces is proving inadequate to maintain effective SPS experiments. The recommendations by the LTPP Committee propose major changes in the SPS traffic data collection effort. These changes will require uniform national standards for the acquisition, installation, calibration and operation of WIM/AVC equipment, as well as the timely processing of the resulting data. The total estimated cost of implementing the recommendations through FY 2003 nationally is \$10 million, however Mississippi's cost for their SPS sites in FY 2001-FY 2003 is \$19,000.

FY 2001 - \$9,000

FY 2002 - \$5,000

FY 2003 - \$5,000

Pooled Fund Study: ***Structural Improvement of Flexible Pavement Using GeoSynthetics for Base Course Reinforcement***

Host Agency - Maine Department of Transportation

High-modulus geogrids and geotextiles are being marketed as base course reinforcement to increase the structural capacity of flexible pavement sections constructed on weak subgrades. The AASHTO Task Force on Geogrid/Geotextile Specification is attempting to develop design standards for aggregate base course reinforcement; however, this effort is being hindered by the lack of field performance measurements for pavement sections designed for traffic loadings typical of state DOTs. This study will provide this missing data by constructing full-scale sections of pavement and underlying subgrade and then loading these pavements to failure using a Heavy Vehicle Simulator (HVS). Reinforced and unreinforced sections will be compared considering the effects of subgrade strength, aggregate base course thickness, pavement thickness, and frost action. A total of 32 sections will be tested with 8 sections tested per year. The study is estimated to cost \$2,120,000. MDOT will contribute a total of \$100,000 during the fiscal years 2002 through 2005.

FY 2002 - \$25,000

FY 2003 - \$25,000

FY 2004 - \$25,000

FY 2005 - \$25,000

Pooled Fund Study: ***Investigate Aggregate Shape Effects on HMA Performance Using Image Analysis Approach***

Host Agency – FHWA

Aggregate shape factors such as angularity and flat and elongated ratio as well as surface texture influence hot-mix asphalt (HMA) behavior and performance. The shape of aggregate particles has been related to permanent deformation, fatigue resistance, shear resistance, and skid resistance of the pavement. There are currently no standard test methods for directly and objectively measuring these coarse aggregate parameters. The qualitative indirect methods now used by the paving industry are quite tedious. The recently developed image analysis system, referred to as the University of Illinois Aggregate Image Analyzer (UI-AIA) will be used in this research to quantify shape, angularity, gradation, and surface texture of coarse aggregates from video imaging in a fast and automated way. In Phase I of the proposed research study, coarse aggregate samples will be received from the NCAT Pavement Test Track Facility in Auburn, Alabama. These samples will be taken from the materials used in the construction of that test track. Phase II of this study will focus on an evaluation of shape and size effects of coarse aggregate on hot mix performance. The study is estimated to cost \$80,000 for Phase I. A decision to proceed with Phase II will be made at a subsequent date for an additional cost of \$70,000. Two years will be required to complete both phases of this study at a total cost of \$150,000. MDOT will contribute a total of \$20,000 to this study assuming both phases are implemented.

FY 2002 - \$10,000

FY 2003 - \$10,000

Pooled Fund Study: ***Improve a FHWA Device to Test for Potential Soil Liquefaction Caused by Earthquakes***

Host Agency – FHWA

The New Madrid Fault, located 120 miles north of Memphis, Tennessee, is a seismic threat to north Mississippi. Soft to medium stiff clays are vulnerable to amplified ground motions and loose to medium-dense saturated sands are moderately to highly susceptible to liquefaction and large deformations. The objective to this study is to develop several necessary enhancements to an existing FHWA impulse shear test device. This device provides site-specific information from results of tests performed in-situ on soil deformation characteristics and liquefaction potential needed for seismic analysis procedures. The study is estimated to cost approximately \$400,000 over a three-year period. MDOT will contribute a total of \$30,000 during the fiscal years 2002 through 2004.

FY 2002 - \$10,000

FY 2003 - \$10,000

FY 2004 - \$10,000

Pooled Fund Study: ***Full-Scale Accelerated Performance Testing for SuperPave and Structural Validation***

Host Agency – FHWA

Although the SuperPave system is a vast improvement over previous practices, research conducted by the FHWA has identified shortcomings in the SuperPave binder specification's ability to characterize the performance of modified asphalt binders. The current inability to effectively characterize modified asphalt binders is a growing concern to highway agencies. In 1996, subsequent to the FHWA's findings on the inadequacy of the SuperPave specification, the National Cooperative Highway Research Program (NCHRP) initiated Project 9-10, "SuperPave Protocols for Modified Asphalt Binders." In August 2001, this million-dollar study, conducted by the Asphalt Institute, generated several recommended enhancements to the SuperPave binder specification. Prior to adoption by AASHTO, these recommendations are being validated and reviewed by the Transportation Research Board (TRB) SuperPave Binder Expert Task Group (ETG).

The FHWA, with funding from NCHRP, has completed an extensive laboratory evaluation of the proposed protocols. The second phase of the experiment is employing full-scale accelerated performance testing. The TRB SuperPave Committee recommended that the FHWA seek financing for this portion of the experiment through a pooled fund.

The pooled fund project was established to study, build and test up to 12 lanes of asphalt pavement. The construction of 12 lanes is expected to be completed in September of 2002 with loading of these lanes starting in mid-October. The loading will be accomplished with Accelerated Load Facility (ALF) machines. The ALF loading, laboratory work, and data analysis cost is approximately \$600,000 per year, so the total funding required for this project is between \$1.5 and \$2.0 million dollars over a minimum loading period of 2.5 years. MDOT will contribute a total of \$60,000 during the fiscal years 2003 through 2005.

FY 2003 - \$20,000

FY 2004 - \$20,000

FY 2005 - \$20,000

Pooled Fund Study: ***Falling Weight Deflectometer (FWD) Calibration Centers and Operational Improvements***

Host Agency – FHWA

The objectives of this study are to minimize the variability in pavement deflection data obtained with FWD and to develop and implement long-term plans for FWD calibrations. This study will be conducted in two phases. The first phase would include numerous tasks that would provide an assessment of State highway agency and other FWD owner needs, including a long-term strategy, improved QC/QA techniques for FWD operation, and appropriate training. The second phase would be to implement recommendations from the first phase. Phase I estimated cost is \$175,000 and Phase II estimated cost is \$850,000. MDOT will contribute a total of \$60,000 during the fiscal years 2003 through 2005.

FY 2003 - \$20,000

FY 2004 - \$20,000

FY 2005 - \$20,000

Pooled Fund Study: ***Improving the Quality of Pavement Profiler Measurement***

Host Agency – FHWA

This pooled fund effort will provide agencies with information and first hand experience to address issues and concerns related to profiler operation, equipment, and procedures. There is an increasing need for State Highway Agencies to purchase and upgrade profiling equipment to provide network level and project specific smoothness information. This includes profilers operated at close to posted speed limits that are most often used to determine ride quality on a network level and smaller units, such as lightweight profilers (LWP). The project objectives include:

Deliver sample procurement specification, maintenance guidelines and profile analysis software program

Establish criteria for verification centers and assist with the development of these locations

Develop and deploy a traceable verification center

Provide technical review of software that locates surface imperfections that require corrective repair during construction, can relate the bumps to the highway users and procure for general distribution

The estimated total cost of this study is \$1,632,900. MDOT will contribute a total of \$120,000 during the fiscal years 2003 through 2006.

FY 2003 - \$30,000 FY 2004 - \$30,000 FY 2005 - \$30,000 FY 2006 - \$30,000

Pooled Fund Study: ***Rapid Bridge Replacement Techniques***

Host Agency – Texas Department of Transportation

Following a terrorist attack or some other extreme event, damaged, nonfunctional infrastructure needs to be quickly repaired or removed and replaced. This project will initially identify a broad range of various materials and techniques that have been or could be used to rapidly replace or repair damaged bridges or bridge components. These initially identified materials and techniques will be fully evaluated to identify the optimum combination of materials and techniques to be used to rapidly repair or replace damaged bridges, including design and construction contract incentives for accomplishing such work. Total estimated study cost is \$250,000. MDOT will contribute a total of \$20,000 during the fiscal year 2003.

FY 2003 - \$20,000

Pooled Fund Study: ***Traffic Control Device (TCD) Consortium***

Host Agency – FHWA

The goal of this project is to assemble a consortium composed of regional, State, local entities, appropriate organizations and the FHWA to do the following:

1. Establish a systematic procedure to select, test, and evaluate approaches to novel TCD concepts, as well as incorporation of results into the Manual of Uniform Traffic Control Devices (MUTCD)
2. Select novel TCD approaches to test and evaluate
3. Determine methods of evaluation for novel TCD approaches
4. Initiate and monitor projects intended to address evaluation of the novel TCD's
5. Disseminate results
6. Assist MUTCD incorporation and implementation of results

The duration of this study has not been determined. Estimated total cost per year is \$750,000. MDOT will contribute \$30,000 during the fiscal year 2003.

FY 2003 - \$30,000

Pooled Fund Study: ***TMC Pooled-Fund Study***

Host Agency – FHWA

The goal of the TMC Pooled-Fund Study (TMC Study) is to assemble regional, state, and local transportation management agencies and the FHWA to perform the following:

1. Identify human-centered and operational issues that are common among Transportation Management Center (TMC) operators and managers
2. Suggest approaches to addressing identified issues
3. Initiate and monitor projects intended to address identified issues
4. Disseminate results
5. Assist in solution deployment

The TMC Study will focus on issues that arise from transportation management centers that are part of traffic signal control systems, freeway management systems, or multi-modal systems. Projects may focus on conducting research, operational tests, technology transfer, or training. The definition and selection of projects will be the product of consensus building. MDOT will contribute \$20,000 during the fiscal year 2003.

FY 2003 - \$20,000

Pooled Fund Study: ***Construction of Crack-Free Concrete Bridge Decks***

Host Agency – Kansas Department of Transportation

The purpose of this study is to implement the most cost-effective techniques for improving bridge deck life through the reduction of cracking. The work will involve cooperation between cement companies, contractors and designers. The following tasks will be used to achieve this objective:

1. Develop a detailed plan to construct bridge decks with minimum cracking by incorporating “best practices” dealing with materials, construction procedures, and structural design.
2. Work with State DOT's, designers, contractors, inspectors, and material suppliers to modify designs, specifications, contracting procedures, and structural design.
3. Select bridges to be constructed using “best practices,” and pre-qualify designers and contractors in application of the techniques. Twenty bridges, 10 in northeast Kansas and 10 in other participating states, will be constructed using the new techniques. Researchers from the University of Kansas and state DOT personnel will work closely with designers and contractors to achieve the desired results.
4. Carry out detailed crack surveys on the bridge decks, three months, six months, one year, two years, and three years after construction.
5. Correlate the cracking measured in Task 4 with the environmental and site conditions, construction techniques, design specifications and material properties and compare with earlier data. Similar data from participating states, where it exists, will be incorporated in the analysis.
6. Document the results of the study and prepare and disseminate a final report to participating states regarding the findings of Tasks 1-5.
7. Develop a training program, including a video produced by KDOT Support Services, to assist the participating states in implementing the findings of the study. The program will consist of workshops to be held at the representative state DOT offices. These workshops will be individually coordinated with each participating DOT.

MDOT will contribute a total of \$60,000 during the fiscal years 2003 through 2006.

FY 2003 - \$15,000 FY 2004 - \$15,000 FY 2005 - \$15,000 FY 2006 - \$15,000

Pooled Fund Study: ***Long-Term Maintenance of Load and Resistance Factor Design Specifications***

Host Agency – AASHTO

The objective of this project is to provide timely assistance to the AASHTO Highway Subcommittee on Bridges and Structures in interpreting, implementing, revising, and refining the AASHTO load and resistance factor documents. This effort will include the following tasks:

1. Resolve areas in load and resistance factor documents requiring modification, clarification, or interpretation. This task includes the performance of special studies for provisions of the load and resistance factor documents needing additional development, as directed by the oversight committee
2. Assist the technical committees of the bridge committee with special interpretations of the load and resistance factor documents.
3. Prepare and submit recommended revisions or new provisions, with supporting documentation, for the load and resistance factor documents, based on work performed under Tasks 1 and 2, in a format suitable for consideration for adoption by the bridge committee
4. Maintain a 'Load and Resistance Factor Home Page'. This page shall include the following components: 1) Frequently asked questions and accompanying answers (FAQ's), 2) A mechanism for submitting questions on the load and resistance factor documents. These questions will be directed to the appropriate AASHTO Bridge Committee Technical Committee chair for response, 3) Information on corrections/revisions, 4) Proposed load and resistance factor agenda items for ballot, 5) Editorial changes, 6) Load and resistance factor training provided through NHI and others, 7) Descriptions of other load and resistance factor activities and links to other load and resistance factor web sites

The study is estimated to cost approximately \$400,000 per year for four years. MDOT will contribute a total of \$40,000 during the fiscal years 2003 and 2005.

FY 2003 - \$20,000

FY 2005 - \$20,000

Pooled Fund Study: ***Portable Non-Intrusive Technologies (PNIT)***

Host Agency – Minnesota Department of Transportation

The desire for safe, accurate and cost-effective portable traffic counters has led the Minnesota Department of Transportation (MNDOT) to initiate this pooled fund study. The PNIT project will utilize the experience and facilities that MNDOT and SRF Consulting Group, Inc. have acquired through previous evaluations of Non-Intrusive Technologies (NIT Project Phases I and II). MNDOT will make the NIT field test site in Minneapolis available for this project, providing a cost-effective platform for conducting continued research. The goal of this project is to assemble a group of States and other interested agencies to:

1. Research existing portable systems
2. Build on current designs to design and fabricate a new PNIT
3. Prepare detailed PNIT system design and cost documentation
4. Evaluate PNIT system in the field under a variety of test conditions
5. Disseminate results

The estimated project budget is \$225,000. MDOT will contribute a total of \$15,000 during the fiscal year 2003.

FY 2003 - \$15,000

TECHNICAL AND EVALUATION PROJECT NO. TE-030
HIGH PERFORMANCE CONCRETE PAVEMENT
WORK ORDER NO. DTFH71-99-TE030-MS-12
(State Study No. 137)

TOTAL STUDY BUDGET: \$90,242

TOTAL STUDY COST TO DATE: \$64,666

DATE STARTED: 10/01/99

COMPLETION DATE: 09/30/06

STUDY TITLE:

Resin Modified Pavement Demonstration Project

RESEARCH AGENCY:

Mississippi Department of Transportation

PRINCIPAL INVESTIGATORS:

Randy L. Battey

Background:

Resin Modified Pavement (RMP) is a new composite paving material consisting of a thin layer (2 inches) of open graded hot mix asphalt (HMA) whose internal voids (approximately 30% voids) are filled with a latex rubber-modified portland cement grout. Some of the objectives that the RMP material was developed to address are:

- resist damage from rutting
- resist damage from fuel spillage
- easily to construct with conventional construction equipment
- require no joints
- have comparable life cycle costs with other rehabilitation methods.

Objective:

The objective of this project is to construct a demonstration RMP highway project and compare its performance with ultra-thin whitetopping (Portland cement concrete inlay) and polymer modified asphalt, for a period of five years. The proposed study will be constructed in an intersection with a HMA pavement with a history of rutting and a high traffic loading.

Progress:

Test sections involving the three subject pavements were constructed on US 72 in Corinth, Mississippi in the Spring of 2001. Pre and post construction data was collected on the condition of the sites. An interim (Construction) report has been completed and distributed to interested agencies. This report includes documentation of construction and condition data of these pavement sections.

The post-construction condition of the pavement sections was monitored.

Plans for FY 2003:

Continue monitoring and documenting the condition of the pavement sections.

Cost Estimate for FY 2003: \$10,000

INNOVATIVE BRIDGE RESEARCH AND CONSTRUCTION PROJECT
FHWA Project No. IRBC-0028-01(35)
MDOT Project No. IRBC-110-01(22)

TOTAL STUDY BUDGET: \$1,428,240

TOTAL STUDY COST TO DATE: \$455,000

DATE STARTED: 05/01/02

COMPLETION DATE: 09/30/03

STUDY TITLE:

Zinga™ Demonstration Project

RESEARCH AGENCY:

Consolidated Products, Inc.

PRINCIPAL INVESTIGATORS:

Frank Francois, III

Background:

Corrosion of metals costs the United States economy almost \$300 Billion per year. Approximately one-third of these costs could be reduced by broader application of corrosion resistant materials and the application of best corrosion-related technical practices. In its discussion of bridge related corrosion and the use of coatings on bridges, the Federal Highway Administration in report RD/94/098 stated: "The most critical factor in the implementation of advanced coatings is the relative lack of history as it pertains to the durability of these coatings." The FHWA, in the same report, discusses the effectiveness of using zinc coatings on bridges to achieve long-term corrosion protection. The primary difficulty, however, is in achieving high concentrations of zinc in a coating and achieving the desired adhesion.

Objective:

The primary objective of this project is to successfully remove the lead based paint from the demonstration bridge using a pressure water blast system followed by the spray application of the Zinga™ one-pack compound containing 99.995% pure electrolytic zinc coating. This coating is designed to provide a long-term corrosion protection system applied through the combination of Zinga™ and Zingasolv in a 10 to 1 ratio (10 parts Zingasolv to 1 part Zinga™).

Progress:

The Interstate 110 Back Bay bascule bridge in Harrison County has been selected for this demonstration project. The Zinga™ paint has been purchased by the contractor and the project is scheduled to begin in the fall of 2002.

Plans for FY 2003:

Complete the coating demonstration project and document the results.

Cost Estimate for FY 2003: \$973,240

**Mississippi
Department of Transportation**

RESEARCH WORK PROGRAM

SPR-1(41), Part II

Q56

**For the Fiscal Period
October 1, 2002 to September 30, 2003**



**Prepared by the
Mississippi Department of Transportation
*RESEARCH DIVISION***

**In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration**

**Mississippi
Department of Transportation**

**RESEARCH WORK PROGRAM
SPR-1(41), Part II
Q56**

**For the Fiscal Period
October 1, 2002 to September 30, 2003**